Surface Modeling - VII

In this session you'll be ready to complete all shapes to define the behaviour of a city car. We suggest also to complete some other perviously task about surface because in this session we'll give only the basic description of the commands and the steps to follow. The approach used in this task not repeat the real sequence to project a car body but want only to suggest how use 3d command in some situations.

Table of Contents

1. Step 1 - Upper side of the body car

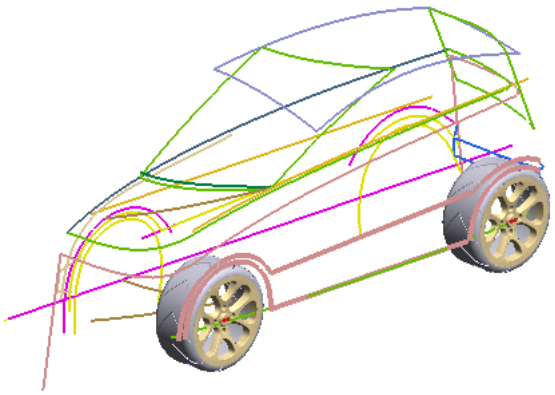
Now let's make the first shapes of our car. We have to define the windscreen, the roof and the rear fixed window.

NOTE.

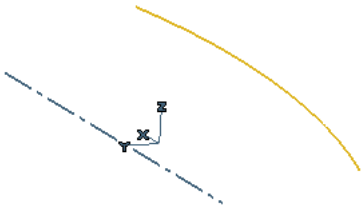
With a double click on the exe file you can run the webtraining session. ThinkDesign will be open with the right model to start..

If request to open a file, you can find it in the C:\MyTraining path.

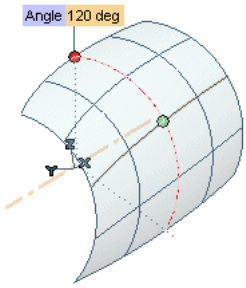
You'll find a model that contains all entities to follow this session. All curves have been taken to define the better shape of the bottle opener images. The curves, for a better usability, have been moved to different layers.



Start the Format Layers and set current layer 0 and active also layer 110 (Glass Curve). All new entities will be make on layer 0; you will use Hide-Unhide command to show or not these surfaces respect the part that we'll work.

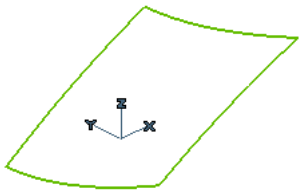


Our goal is to make a rounded surface to represent the glass by a **Rotational Surface**.

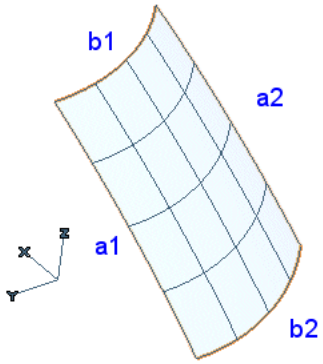


- Start **Rotational Surface**.
- Select as the axis the dot-dashed line and as the curve the 3D curve.
- Set the Symmetric mode and assign 120 degree.

Start the Format - Layers and set current layer 0 and active also layer 115 (Windscreen).



Now let's want to work arounds the windscreen, roof and fixe windows parts using a **Grid Lofted Surface**.



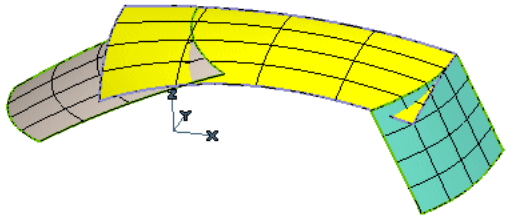
- Start the **Grid Lofted Surface** command.
- Select the boundaries marked a1 - a2 as Boundary Set A.

- Similarly select b1 - b2 as Boundary Set B.
- Set the parameterization as Intrinsic.
- Verify that type has been set on Grid.

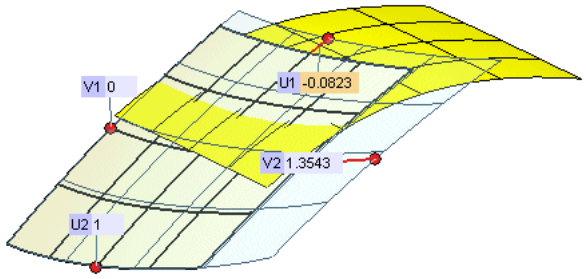
Why Grid and not Proportional Surface?

It is the better mode to keep the same parameterization and obtain quickly a Nurbs entity without to convert it after.

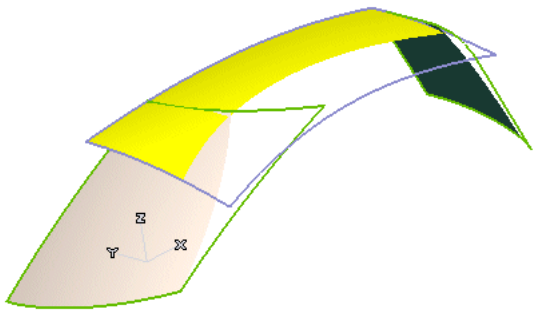
Let's repeat the same steps also with layers 116 (Roof) and 117 (Fixed Window).



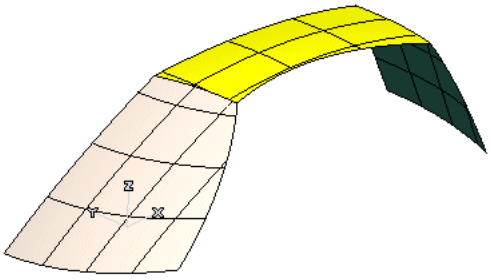
Extend, where necessary, the surfaces in all parts, less in the mirrored part, to obtain a better intersection condition with themself. The internal data of the entities (degree, continuity and arcs) don't change.



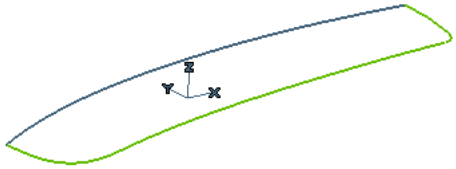
Let's use the **Trim with Limits** to split these three surfaces using the glass rotational surface as reference.



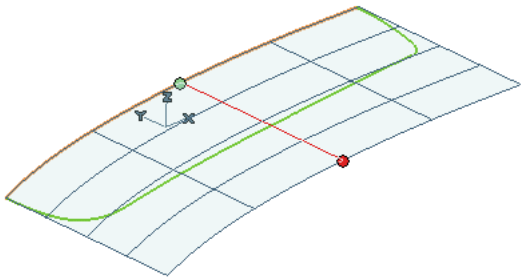
Let's use still the **Trim with Limits** to split themself.



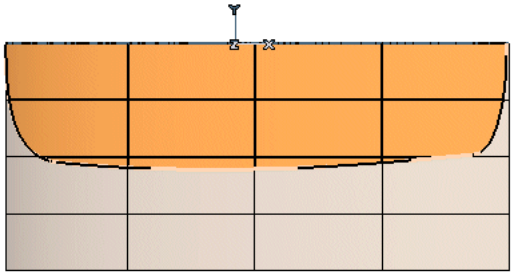
Set current layer 0 and active also layers 102 (Top Body Car).



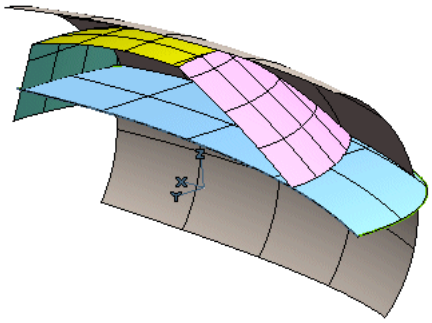
Sketch a **Linear Surface** as a reference such that it extends beyond the green curves as shown below (Y axis in the image).



With green curves, trim the linear surface using the **Trim with Limits** command. Keep the inside highlighted portion of the surface.

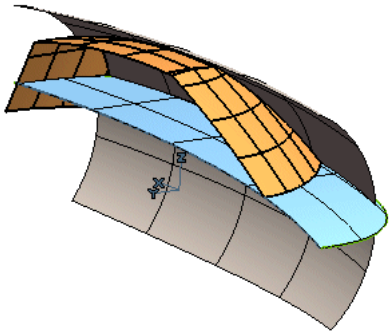


Unhide all surfaces until here made.

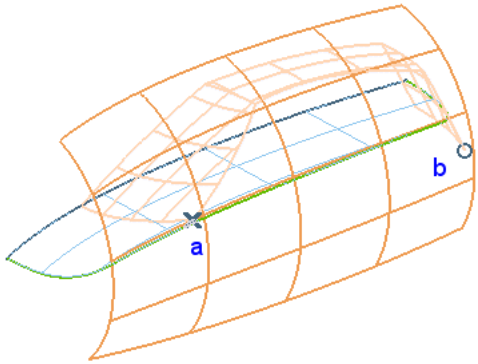


Now let's use again other times the **Trim with Limits**. Our goal is to keep only the right domains that define the top part in our city car.

- Start the **Trim with Limits** command.
- Select the windscreen, roof and fixed window as Limits.



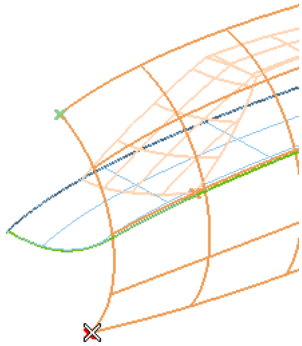
- Select the glass surface as Surfaces.



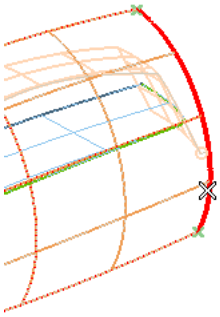
The Warning icon advise you that problems could be in the trim. Pressing it, ThinkID shows two points (a and b) that are the ends of the right curves until here projected on the surface.

Generally we have to exit from the command, adjust the curve and repeat it again. In this version, instead, let's use a powerful tool to fix, inside the active command, our problems.

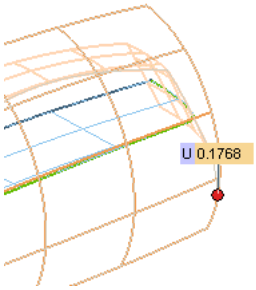
- Set Mode Join dead ends under More Options and Manual Repair.
- Select point a and then the bottom left limit point on the same surface by Point or Surface Corner to Connect.



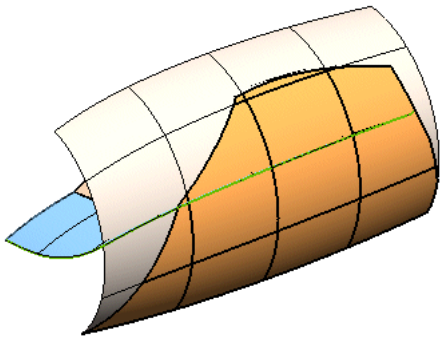
- Continue now selecting point b.
- Active Surface Boundary Edge to Connect and select the right boundary of the surface to trim.



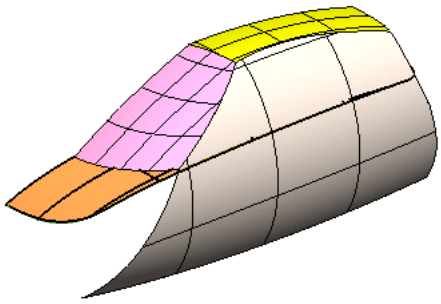
- The minidialog shows the current parametric data in this position on the selected boundary. Move it down if necessary.



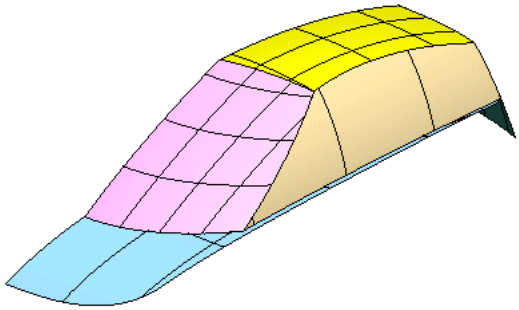
- Active Region to Keep and select the internal domain to keep.



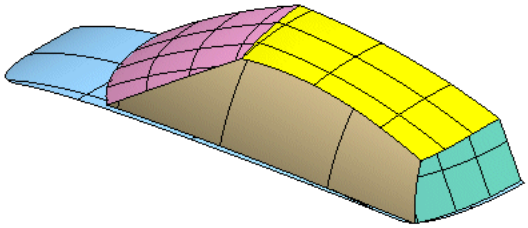
To reset these impositions for wrong selection, set Mode Remove manual constraints under More Options and Manual Repair.



- Start the **Trim with Limits** command.
- Select the windscreen, roof and fixed window as Limits.



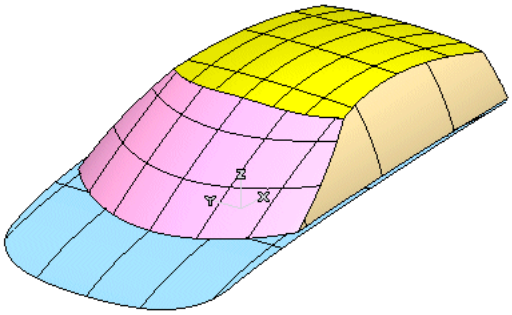
At the end of this step you'll obtain these geometries.



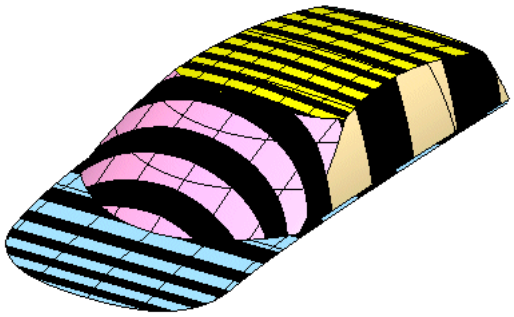
Inside **Options/Properties** - Document Properties - View- Advanced selecting Enable under Virtual Mirror, you'll obtain mirror graphic entities taking advantage to the OpenGL graphic libraries.

Virtual mirrored entities.

This is a mirrored preview of the model displayed symmetric to the plane specified (It is a virtual image of the portion - it is not actually there.) This is a useful tool in cases like this task where you are creating complex surfaces for a car model. You would want to check regularly if the entities you are creating are correct but do not want to slow down your system performance too much. Having this mirroring option allows you to view the mirrored graphic entities without actually sketching the geometry.



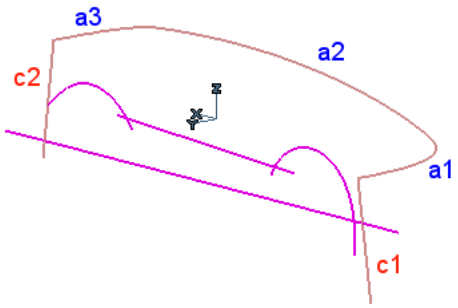
The advatage is also for the analysis by zebra lines or other modes without to replicate the geometry each time in the mirrored part.



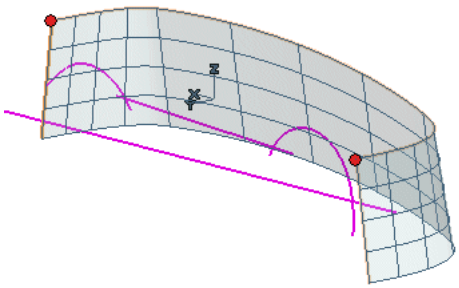
2. Step 2 - Upper side of the body car

Let's start by defining a part of door, quarter panel and front-rear fender. As reference, we'll use the marked curves in the images below in the Side View.

Set current layer 1 and active also layers 106 (Lateral Body).



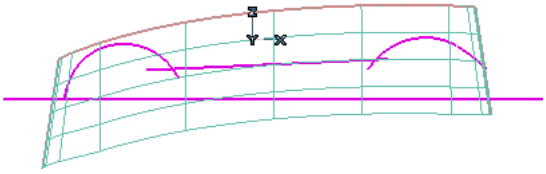
- Start the **Global Sweep** command.
- Select a1 - a2 - a3 curves as Drive Curves.
- Select c1 curve as Curves 1 under Section Group(s) 1.
- Select c2 curve as Curves 2 under Section Group(s) 2.



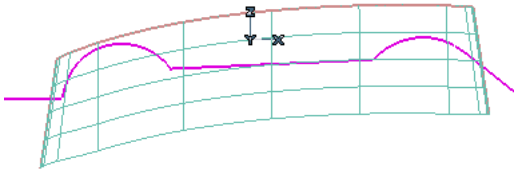
- If necessary under More Options use Invert to assign the correct behaviour for the shape.
- In the Motion Mode select Constant axis and assign Z as Direction.

Let's split the surplus material.

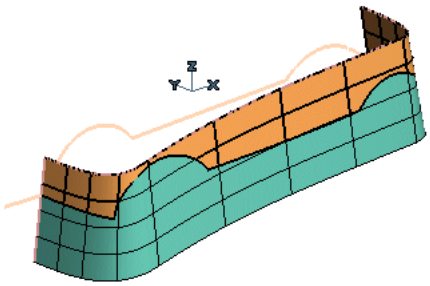
- Use the XZ plane as view orientation.



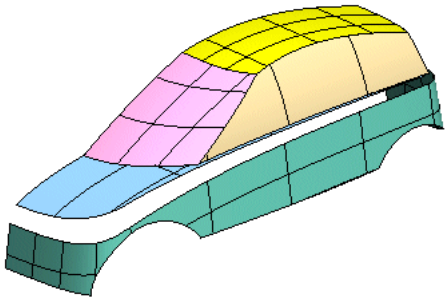
- Trim and extend the curves by Modify - Curve - Extend Tangent.



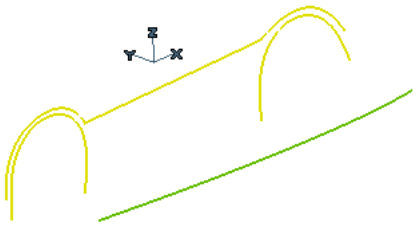
- Using same orientation, start the **Trim with Limits** command and keep the upper side.



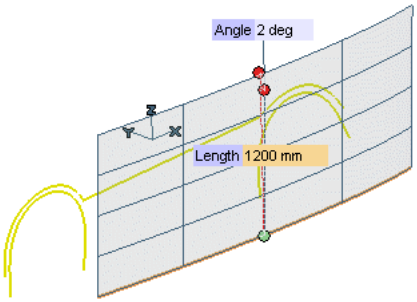
Here, the all surfaces made.



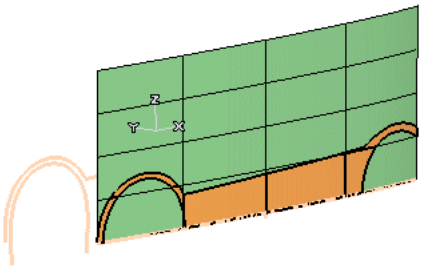
Set current layer 2 and active also layers 120 (Fender).



- Start the **Linear Surface** command.
- Select the external curve.
- Insert in the minidialogs the values Length1200 and draft Angle2.The angle must to be pointing towards the outside as seen below



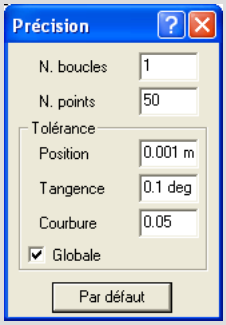
- Use the **Trim with Limits** command with the XZ view orientationa to trim also this linear surface. Keep bottom side.



Note.

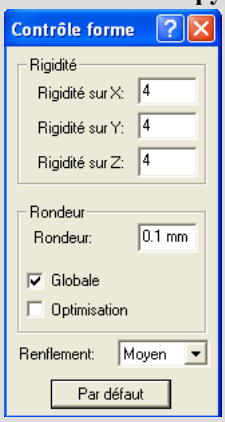
In this step, we need to make linear surfaces. In real modeling it is necessary to use and understand the "bulge" behavior.

A quick way to understand this, is by **Advanced Modeling**. Its possible to create the same shape with other methods, but if you have lot surfaces to bulge, **Advanced Modeling** will be fundamental.

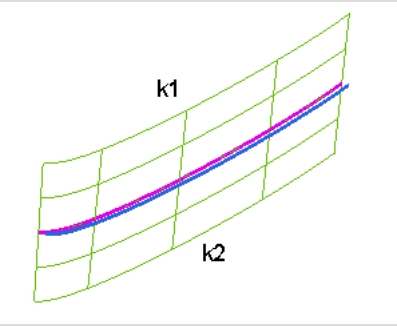


Create an internal curve using **Isoparametric Curve** command as shown above.

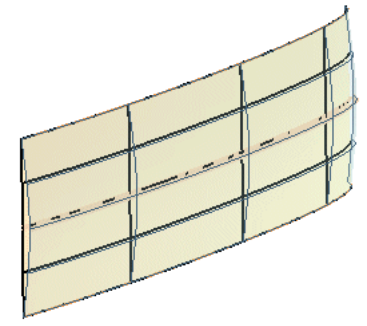
- Use **Move Copy Entities** command and copy the curve in the external side of the car body.



Start **Advanced Modeling** command and assign k1 - k2 (the two external curves) as curves to preserve keeping position constraint.

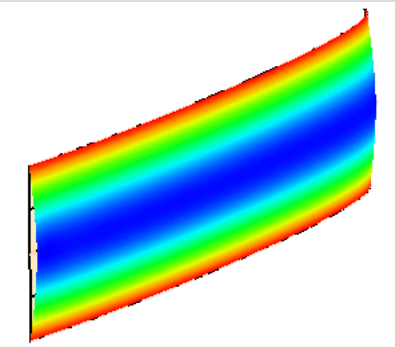


Select magenta curve and blue (moved) curve respectively as the Initial and Target Curves under the Matching Curves option. Impose ConstraintTarget Position for this shape change.

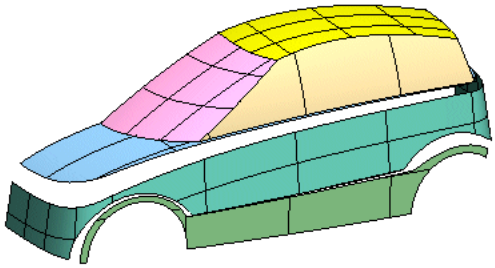


Under More Options - Quality Check, GSM tab, Check the Enable box and you can check the real distance between the parametric points on the first and new surfaces.

The shading is done to analyze distances between points in this modification. The Zone with maximum distance is shaded Blue and those with shortest distance in shaded Red. This check will give you an idea of uniformity of the modification.

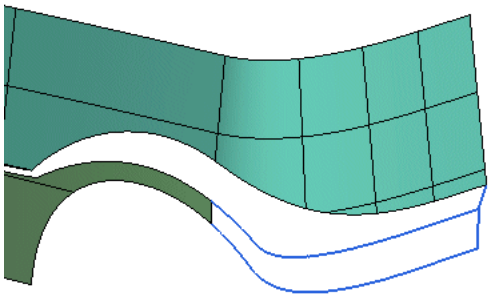


These tools are important to analyze the geometries in an interactive mode while you design your shapes .



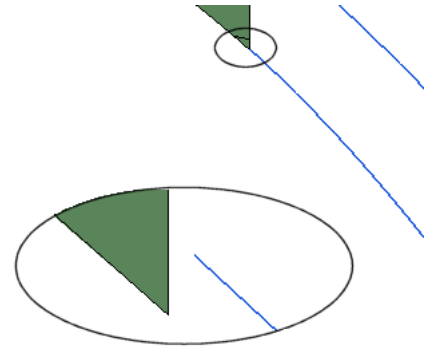
Now let's work in the rear side of our city car; it needs to define the shape of the rear bumper.

Set current layer 2 and active also layers 1 and 107 (Rear Bumper).

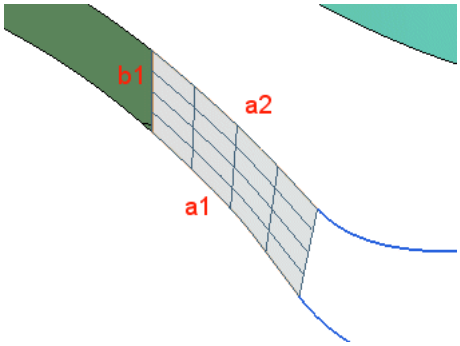


Zooming the geometry, as showed below, it is possible that the positional continuity isn't satisfied. If you try to

make a lofted surface (2 curve as A and 1 boundary as B) you'll find the gap distance by Warning message.

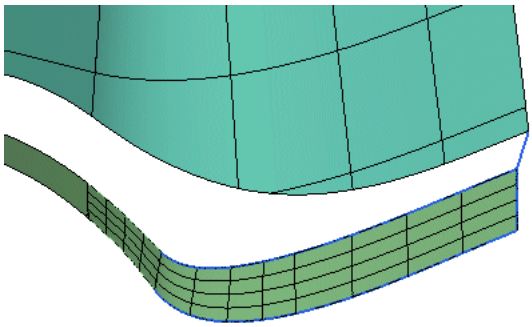


In these cases tou have to use **Curve Continuity** or **Advanced Curve Continuity**; establish you a prefered continuity. If you use high continuity, you have to reduce the weight.



- Start the **Lofted Surface** command.
- Select a1 - a2 as Boundary Set A.
- Select b1 as Boundary Set B.
- Set the parameterization as Intrinsic.

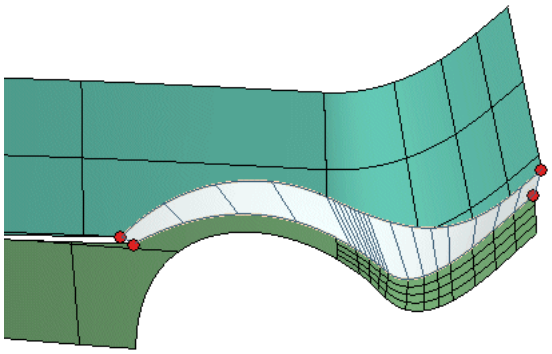
The two others could be sample ruled surfaces.



Let's close these discontinuity.

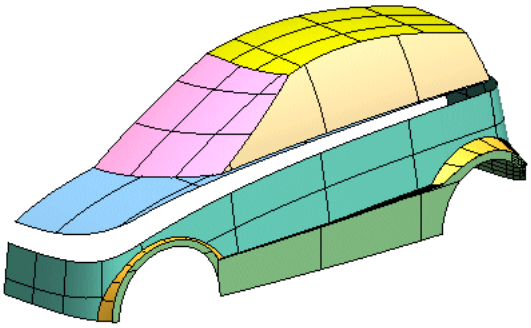
- Hide all curves or unactive the layer 107.
- Start **Blending Shapes** command.
- Select the upper boundaries as First Curves.

- Select the reciprocal lower boundaries as Second Curves.
- Set Continuity - Position for both.
- Set Discontinuity order - Curvature.



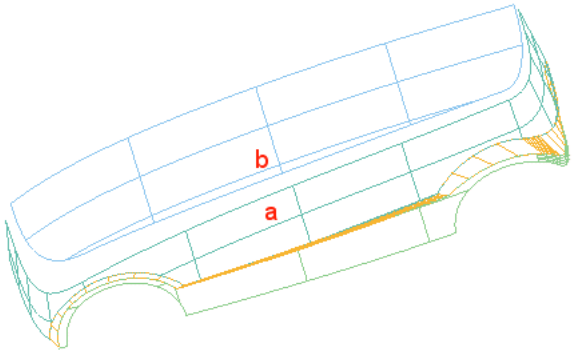
Continue to close the other gaps using ruled, in the center of the car, and blending shapes in the front fender.

Set current layer 2 and active also layers 0 and 1.

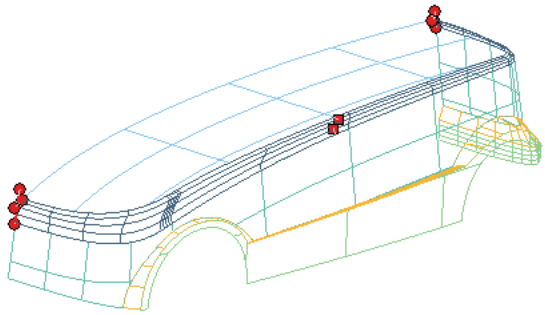


Just arrived at last surface to close the main body car.

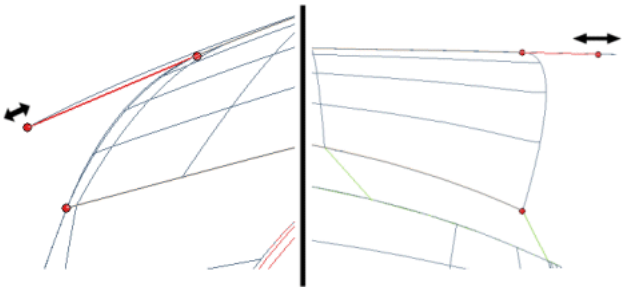
- Start **Blending Shapes** command.
- Select the lower boundaries as First Curves.



- Select the reciprocal upper boundaries as Second Curves.



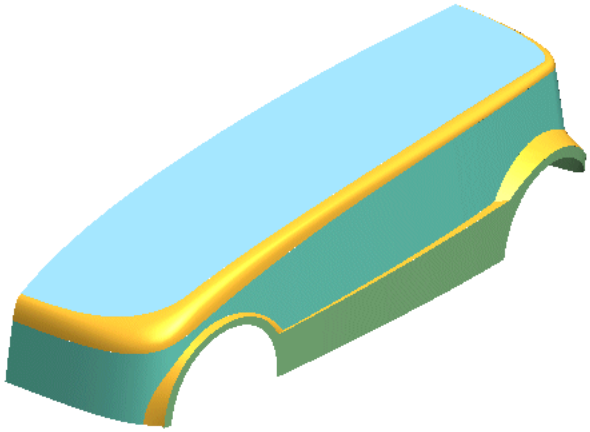
- Set Continuity - Curvature for both.
- Set Discontinuity order to Curvature.
- Set Degree - 3 under Tangent Lenght Law.



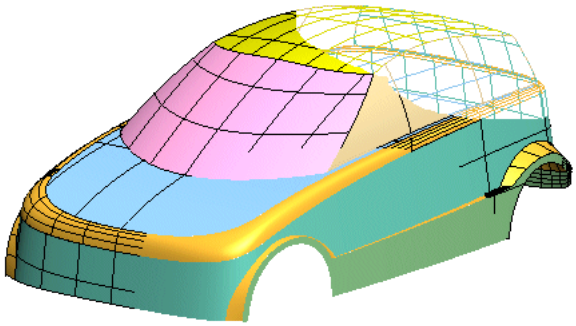
Check the areas as shown in the above images at the front and rear of the car. You can drag the red handle to obtain the better shape, invert their direction if needed and check the shape of the surface in preview.

With one command ThinkdiD permits you to define a complex surface with many chains of groups, curves or surface boundaries.

Rotate the model to obtain a better view. Drag the red pointers to get the shape of the new surface as shown below.



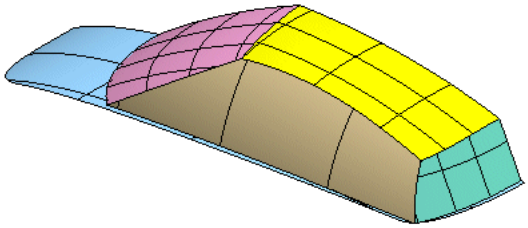
Use Virtual Mirror Plane to see the complete shapes.



3. Step 3 - Body Car

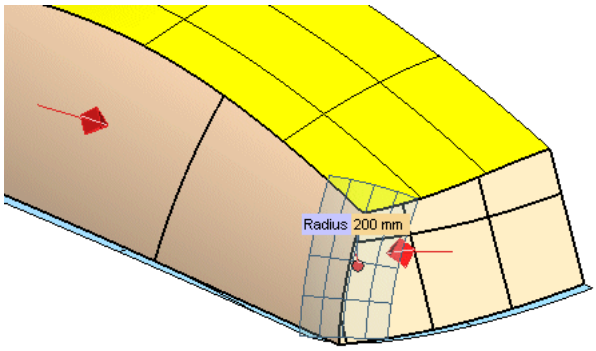
We are at the last step to complete the car to round the behaviour in the upper body of the city car. We'll use a series of solid fillets, features more right to reduce the time of the modeling.

Set current layer 0 and active itself; off all others.

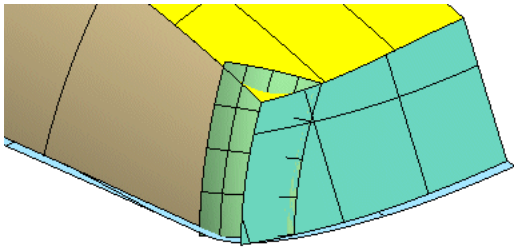


Let's remove some tancency discontinuity using in this step the surface modeling.

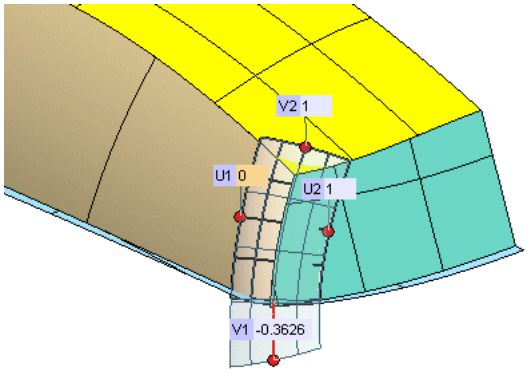
- Start **Double Fillet**
- Select the glass and fixed window surfaces.
- The arrow, in each surface, has to be inner.



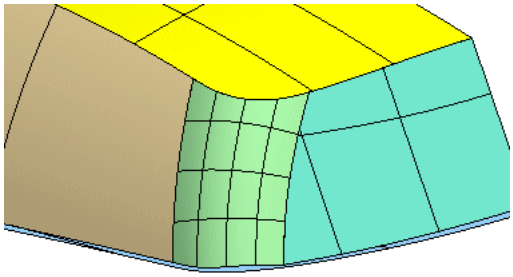
- Choose Constant mode and impose R200.
- Set Continuous curvature under More Options.
- Set Weight - 0.5.
- Full as Extension.



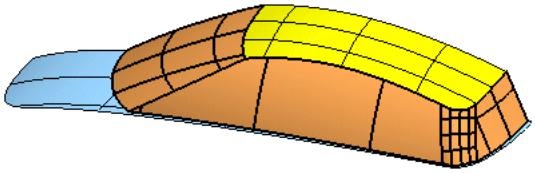
It need to **Untrim Surface** and **Trim Extend Surface** for find the right intersection with roof and hoos surfaces.



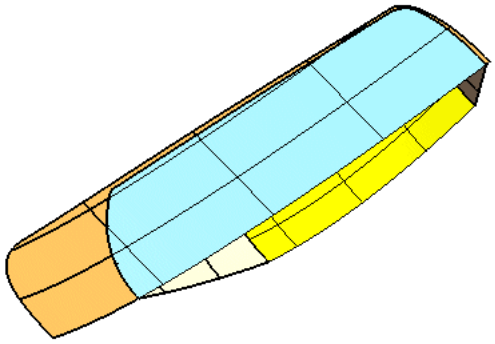
- Use a sequence of the **Trim with Limits** command to trim all surfaces in their intersection; below the result.



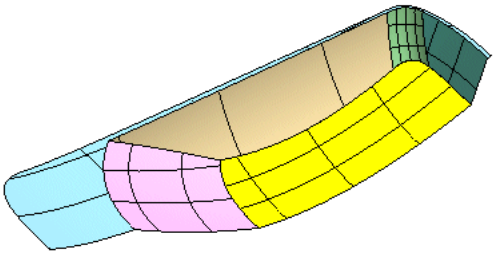
- Use the **Trim with Limits** to split the extended hood surface; use windscreen, glass and fixed window surfaces as limits.



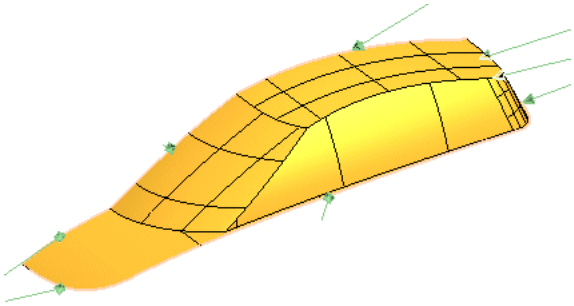
- Keep the external domain.



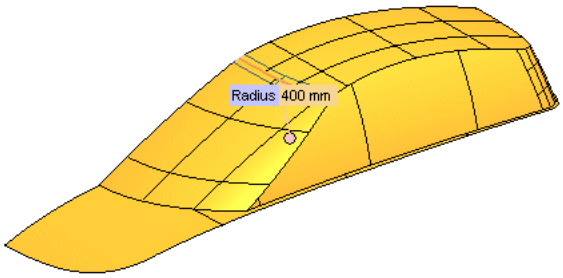
Here the result.



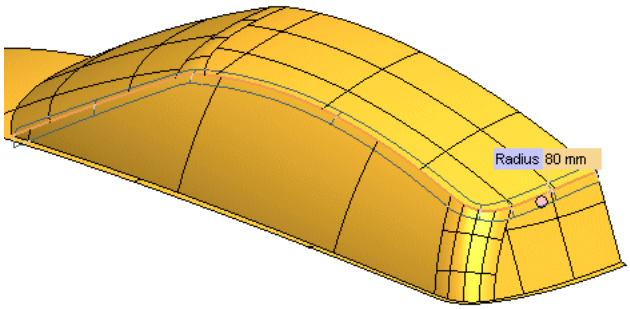
- Start **Make Solid** and select all surfaces..
- The solid will be open in all external boundaries; hit continue.



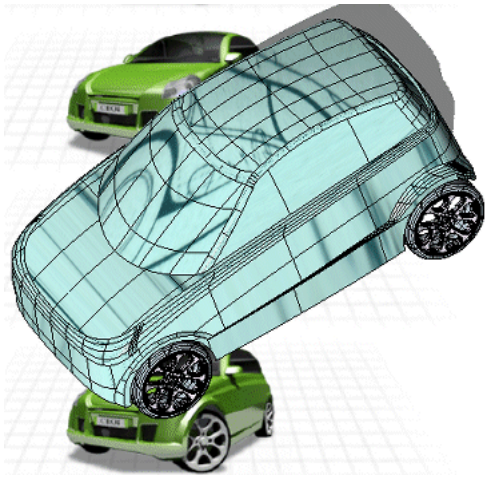
- Start **Fillet Edges** and select the ../../../../../Common edge between roof and windscreen.
- Choose Constant Radius mode and impose R400.
- Set Continuous curvature under More Options.
- Set Weight to 0.5.



- Start **Fillet Edges** and select the ../../../../../Common edge between roof and windscreen.
- Choose Constant Radius mode and impose R80.
- Set Tangency Chain under More Options.
- Set Continuous curvature.
- Set Weight to 0.6



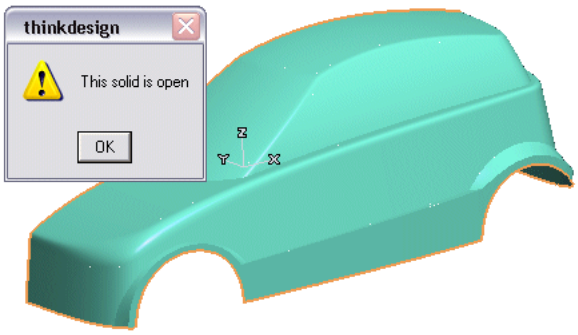
We now have the complete body of a city car starting from some styling images with all its characteristic shapes.



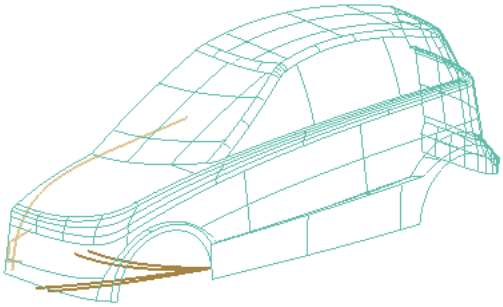
4. Step 4 - Hood and Front Bumper

Now we'll concentrate on the front of the car to get our desired shapes on the hood and front bumper.

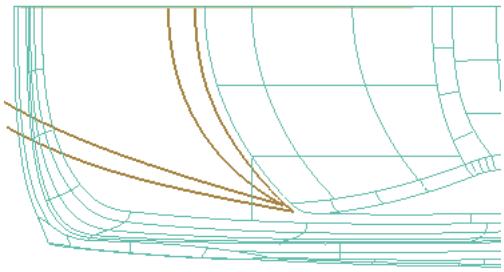
- Start **Make Solid** and select all surfaces..
- The solid will be open in all external boundaries; hit continue.



Set current layer 2 and active also layers 0, 1 and 118 (Hood).

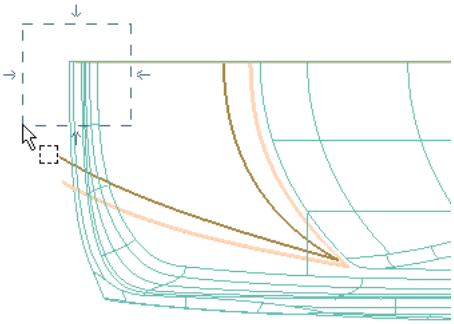


let's need to use these curves, by Z view direction, to split the hood in two sides.We cannot use **Trim with Limits** because just working with associative or solid entities.



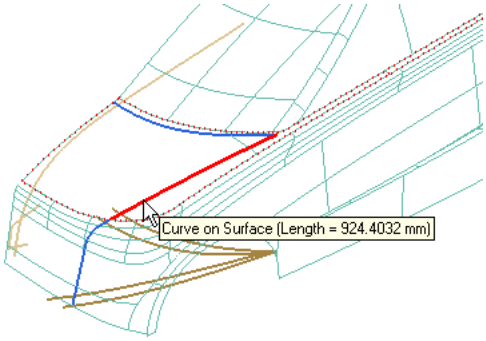
First : let's project these curves on the hood

- Start **Project Curve** and select the two external Nurbs curves.
- As shown in the image use the window filter (from right to left) when need to select the hood and the front bumper.



- You can use Pierce or View direction.

- Check Associative.
- Check Insert Curve on Surface.



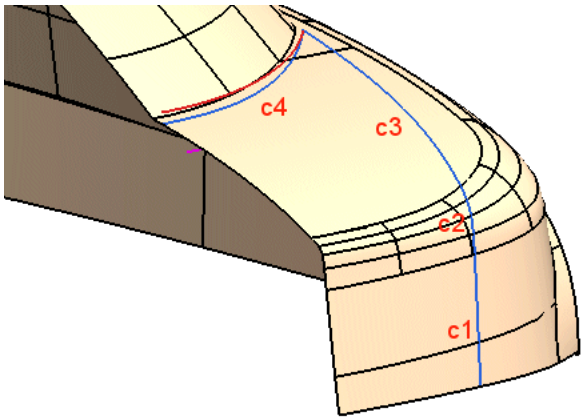
Note: Curve on Surface.

A special type of curves is available in thinkdesign: Curve on Surface or COS.

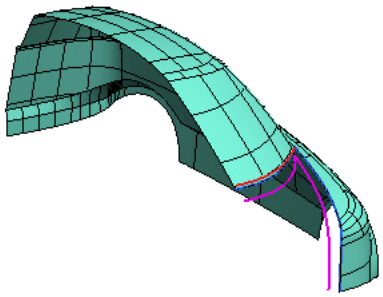
Curves on surfaces are curves which keep a link to the surfaces they were created on. Thanks to this basic characteristic, their behavior is very smart and can be very useful in a number of situations.

Study in depth these arguments in the Help on Line.

Second : These four curves are necessary to split the hood.

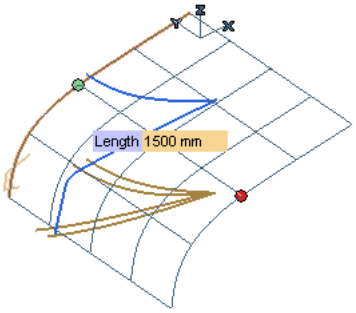


- You need to use **Split faces** and by the same faces used in the project command, split them with Cos curves.
- As shown in the below image, use **Hide Entities** for the inner hood's faces after to have unlinked them by **Break Solid** with local mode.



Now we have to close this split.

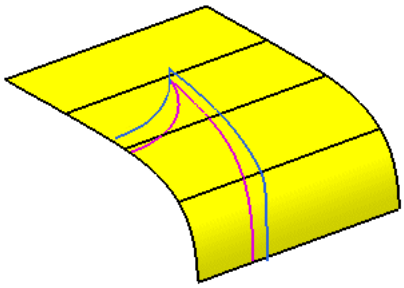
- Sketch a **Linear Surface** with the new curve in the Z direction.



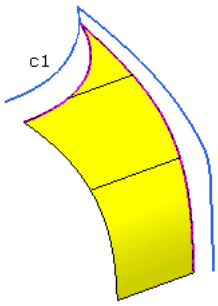
- Start **Project Curve** and select the two internal planar Nurbs curves to split the linear surface.

- Check Associative.

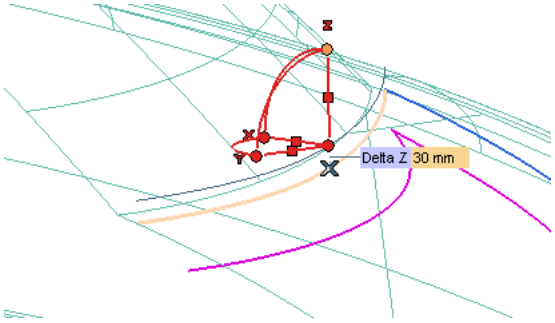
- Check Insert Curve on Surface.



- Split the Linear surface by **Split faces** and keep the inner side.

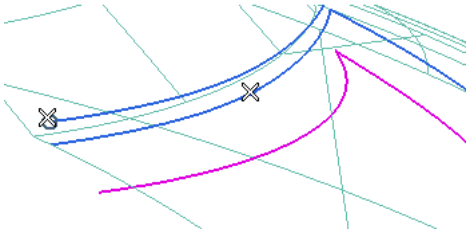


Use **Move Copy Entities** to make a copy about 30mm in the Z direction of the above curve c1.

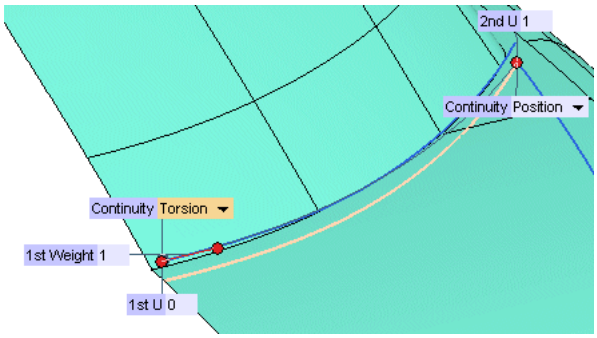


We will now add a new curve to describe a style shape of the hood for the better air flow on the windscreen.

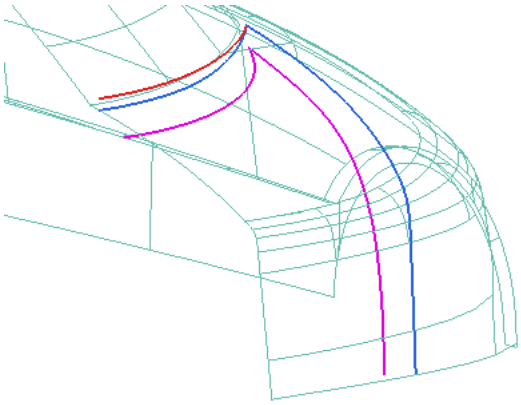
- Start **Connect Curve**.
- Select the end of moved curve as first.
- Select a point on the reference curve as second.



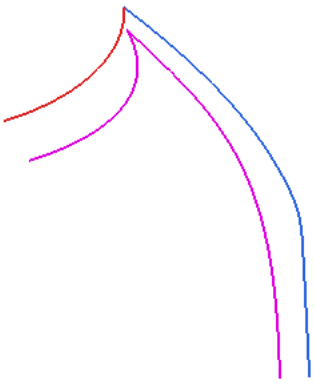
- Start **Connect Curve**.
- Set Torsion continuity on the first.
- Move the second point until to arrive in the opposite limit and impose Position continuity.
- Uncheck Associative and Curve on Surface



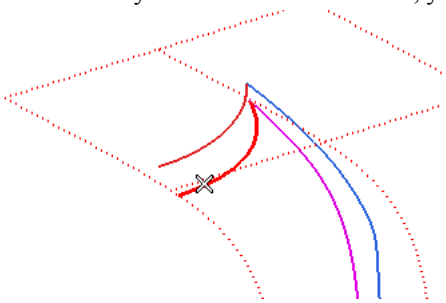
Here the current status of the geometries.



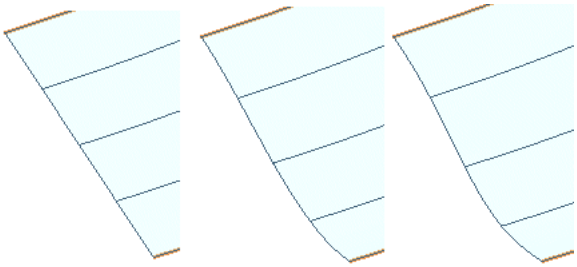
Hide temporary all entities without the showed curves.



- Start **Lofted Surface** and impose Grid mode.
- Select the showed curve as Boundary Set A and the connect curve as Boundary Set B.
- Boundary A is a COS curve. Good, you've the possibility to impose different continuity.



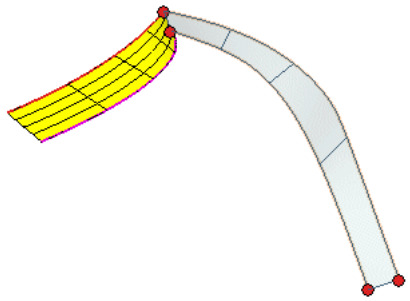
Below you can see the different behaviour by Position, Tangent or Curvature constrain.



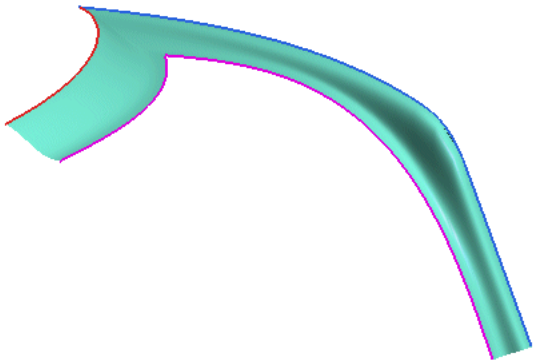
- In this task use the Continuity - Curvature.

OK! Now are you ready to define the adjacent shape, always in the hood.

- Start **Blending Shapes**.
- Select the two chains shown below as First Curves and as Second Curves.

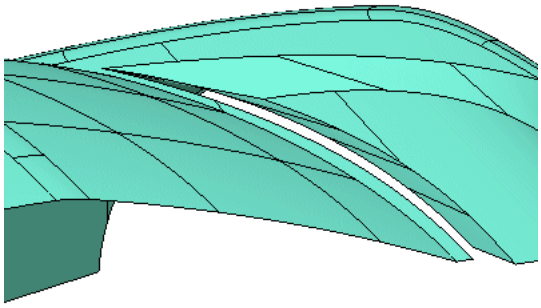


- Set Continuity - Curvature for both constraints

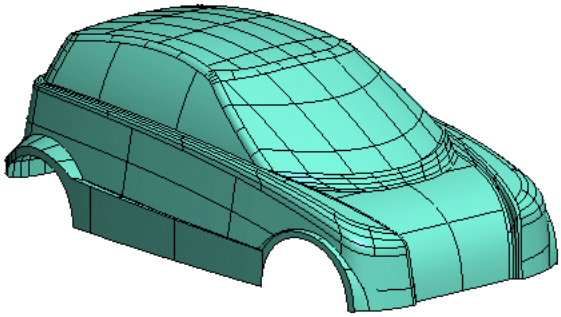


Use **Trim Extend Surface** and **Trim Surface with Limits** to obtain a positional condition with themself.

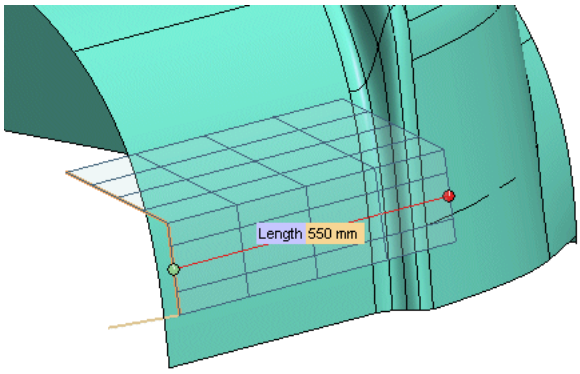
Using a ruled surface close the gap between windscreen and hood.



Let's continue our job inserting other shape in the front for the plate and fog lights.

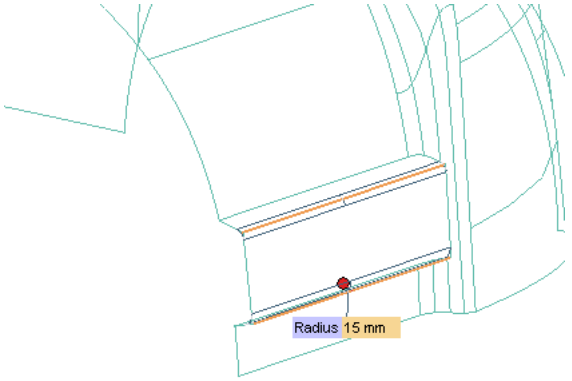


Sketch a **Linear Surface** with the new curve in the Y direction setting the lenght at 550 mm.

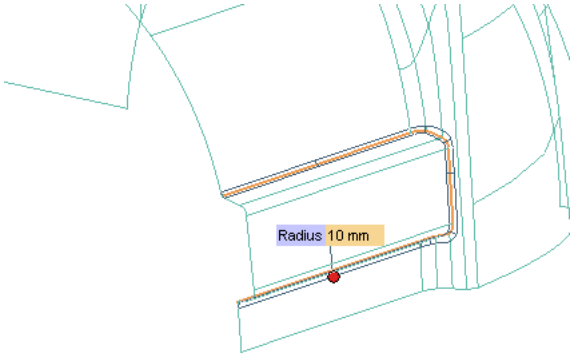


Check the normals of the open solid and the by Boolean operators, add this new part to all car.

- Use **Fillet Edges** to create two R15 fillets on the front edges.



- Use **Fillet Edges** to create one R10 fillet on the chain edges.

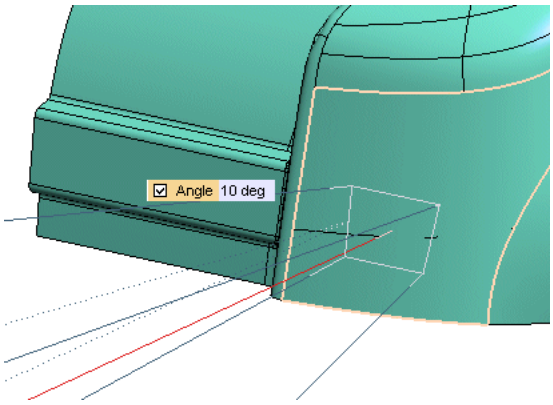


Now we are ready to define the fog light.

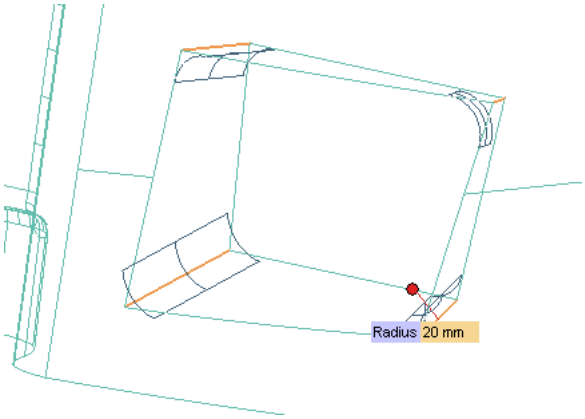
Set current layer 2 and active also layers 0, 1 and 119 (Fog Light).

- Use **Linear Slot** and select the profile.

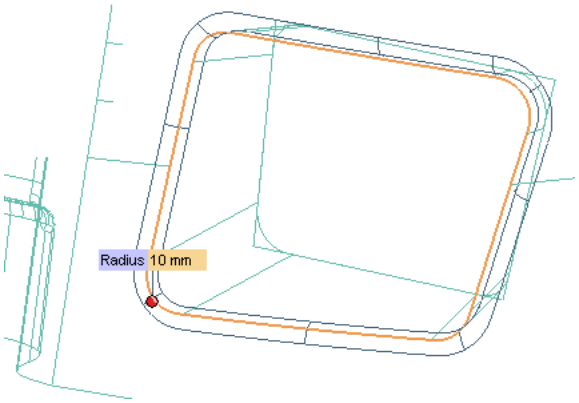
- Direction has to be in the external side and assign also the 10 degree of draft.



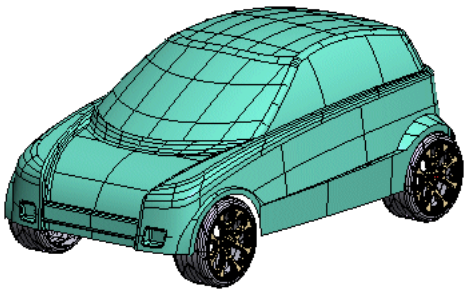
Insert the fillets on vertical edges.



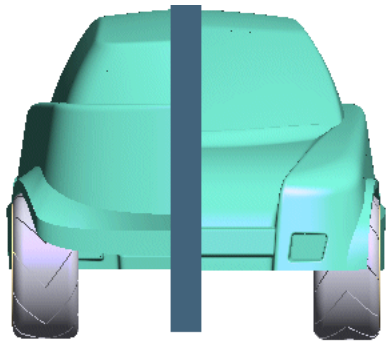
Now the fillet on the top edges.



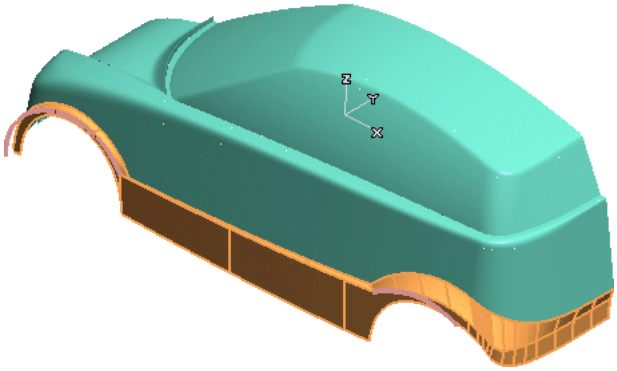
Here the current status of our car.



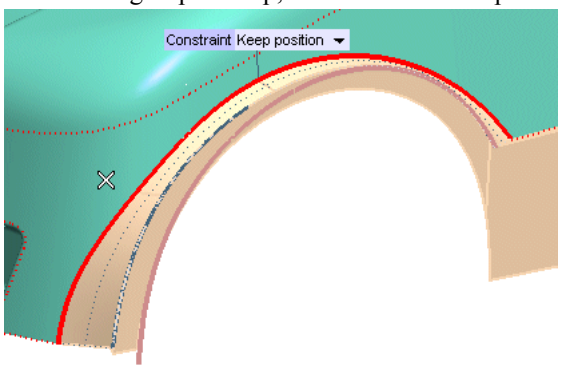
As shown below there is a problem because the front and rear splash shield don't cover the wheels.



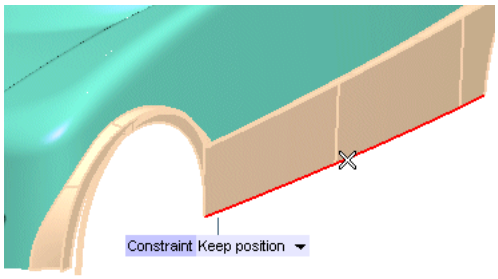
- Let's use **Advanced Modeling** or **Zone Modeling** to correct this problem.
- Select the highlight surfaces as entities to modify..



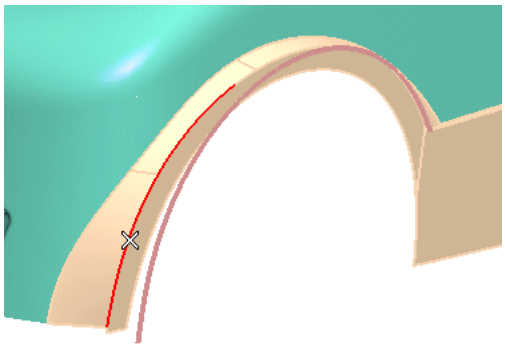
- As first group to keep, select the internal splash shield boundary.



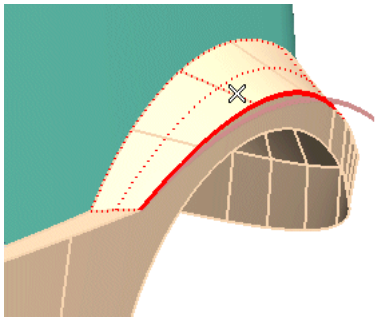
- Follow in the same group the chain until to select the boundaries on the rear bumper .
- Impose ConstraintTarget Position for these.
- As other group to keep select the bottom rocker panel curve.
- Impose ConstraintKeep Position also for it.



- As curves to matchinig, select the outer edges on the splash shield. These edge have to arrive until the generic curves.
- Impose ConstraintTarget Position.

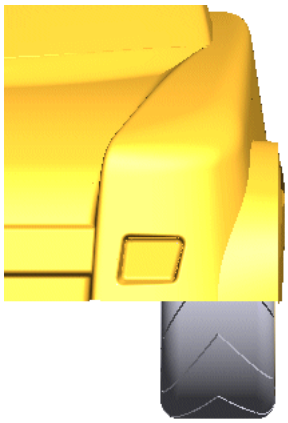


- Same selection in the quarter panel.
- Impose ConstraintTarget Position.



- You have to adjust the parameters in the Shape Control and Precision to remove some discontinuity and obtain your prefered behaviours.

Now the wheel are perfectly covered.



Done!.